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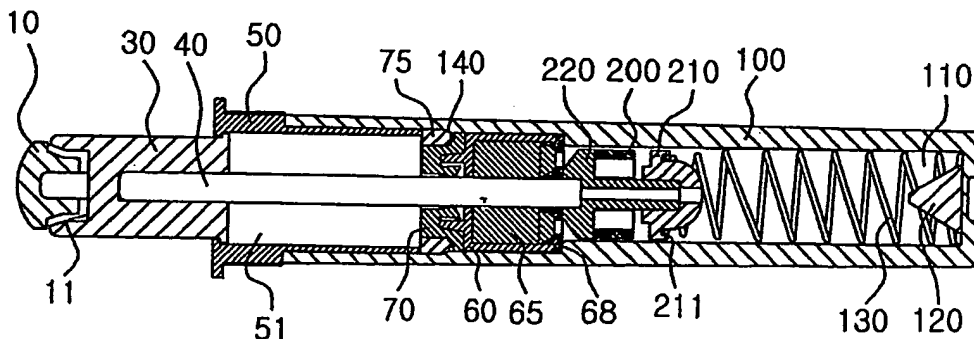
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- (71) Applicant: MOONJU HARDWARE CO., LTD [KR/KR]; 623-2(Namdong Industrial Complex 10B-3L), Namchon-Dong, Namdong-Gu, 405-846 Incheon (KR). For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DOOR DAMPER



(57) Abstract: A door damper includes a housing main body in which an oil chamber is defined by an oil seal. A piston rod is inserted into the housing main body, and a cylinder guide and first and second check valves are assembled on a proximal end of the piston rod to control the flow passage of oil. A spring is disposed between the piston rod and the housing main body to attenuate impact. A space guide bushing is formed on an opening of the housing main body, and a bumper-fixing cap fitted on a distal end of the piston rod and a bumper are associated with the space guide bushing. A variable gap is formed on the second check valve to effectively reduce large impact and an oil seal ring is depressed into the oil seal to prevent the oil leakage when excessive pressure is applied.

DOOR DAMPER**TECHNICAL FIELD**

The present invention relates to a door damper, and
5 more particularly, to a door damper for preventing impact and
noise that are generated when a door of home furniture, sinks
and the like collides with a doorframe in the course of being
opened and closed.

10 BACKGROUND ART

Generally, a door is pivotally attached on a sink or
furniture such as a wardrobe, a bookcase and the like by a
spring hinge. When being opened and closed, particularly when
being suddenly closed rather than being opened, the door
15 collides with a doorframe to generate impact and noise, or be
broken sometimes in the worst case.

In addition, when the door is suddenly closed, user's
finger(s) may be held between the door and doorframe, thereby
being wounded.

20 Particularly, for children who are not so attentive,
the above-described problems may be more severe.

To overcome the problems, Korean Patent No. 20-0294107
to the applicant of this invention discloses a door damper,
which will be described hereinafter with reference to Fig. 1.
25 As shown in the drawing, the door damper disclosed in the
patent comprises a housing divided into an oil chamber 113
and an oil leakage preventing chamber; a rod inserted in the
housing and provided at its outer circumference with an oil
passage groove; first and second check valves 210 and 200
30 provided with plural oil passages, the first and second check

valves being mounted on the rod and disposed in the oil chamber 113 such that the oil passages can communicate with the oil groove; a spring 190 for biasing the second check valve 200; a bushing 180 provided at its outer circumference with a packing and seated on the oil leakage preventing chamber; an oil seal 170 abutted on the bushing 180, the oil seal 170 having a shaft and a flange; a coupling projection having an outer bottom with a seating projection and an inner bottom with a coupling groove in which the shaft of the oil seal is inserted; a return spring 150 having a first end mounted around the seating projection formed on the outer bottom of the coupling projection; a fixing cap 140 mounted on a second end of the return spring 150; a separation preventing member for preventing the bushing 180, the oil seal 170, the housing cover 160, the return spring 150, and the fixing cap 140 from being separated from the rod; and a bumper 130 coupled on the fixing cap 140. Such a door damper is designed such that, when impact is applied, it is firstly absorbed by the bumper, and then further absorbed by the return spring 190 and the oil passing through the first and second check valves 210 and 200.

However, when the door fixed on the doorframe by a spring hinge is being opened and closed, noise is generated by air bubbles, that are formed in the oil chamber in the course of manufacturing the door damper, as the oil within the oil chamber passes through the first and second check valves. In addition, when the door is rapidly closed, the noise becomes more severe due to bounce of the door from the bumper. Furthermore, when excessive pressure is applied to the oil, the housing defining the oil chamber can be bent

outward, as a result of which a minute gap between the oil seal and the housing main body may be formed, causing a leakage of the oil.

5 DISCLOSURE OF THE INVENTION

Accordingly, the present invention is directed to a door damper that substantially obviates one or more of the problems caused by limitations and disadvantages of the related art.

10 An object of the present invention is to provide a door damper that can (1) eliminate noise caused by air bubbles by minimizing the generation of the air bubbles within an oil chamber in the course of manufacturing the door damper, (2) avoid bounce of a door from a bumper by forming a space
15 between a bumper and a bumper fixing cap even when the door is abruptly closed, thereby preventing the noise, (3) attenuate impact by remarkably reducing an amount of oil passing through first and second check valves even when the door is suddenly closed, and (4) prevent a leakage of oil by
20 blocking a minute gap that may be formed between an oil seal and a housing main body when the door is rapidly closed.

In order to achieve the above object, the present invention provides a door damper comprising a housing main body having proximal and distal ends, the distal end being
25 opened and the proximal end being closed, the housing main body having a relatively large inner diameter wall and a relatively small diameter wall and being provided at the inner diameter walls with first and second steps, a spring seating projection being formed on an inner wall of the
30 proximal end; a piston rod disposed in the housing main body;

an oil seal ring mounted on the first step; a tube guide bushing closely abutted to the oil seal ring; a seating ring contacting the tube guide bushing and fixed by the second step; a tube-shaped contracting member disposed in the tube guide bushing; a cylinder guide connected to the piston rod to be slidable along the small inner diameter wall of the housing main body; a first check valve fixed on a proximal end of the cylinder guide; a second check valve slidably disposed between the cylinder guide and the first check valve; a spring mounted between the spring seating projection and the first check valve; a space guide bushing movably fitted on the distal end of the housing main body, the space guide bushing being provided with a flange; a bumper fixing cap mounted on a distal end of the piston rod; and a bumper disposed in a space defined on the bumper-fixing cap.

Preferably, the cylinder guide is provided with a central hollow hole, and the first check valve comprises a 4-way oil passage groove, a spring seating groove, and a central hollow hole.

Further preferably, the second check valve comprises four radial projections formed on an inner wall of the second check valve.

The door damper may further comprise an oil seal having a flange abutted on the oil seal ring, wherein the oil seal ring is provided with a circular projection that is depressed into the flange of the oil seal.

Preferably, the bumper is spaced away from the bumper-fixing cap at a predetermined distance.

Additional features and advantages of the invention will be set forth in the description which follows, and in

part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims thereof as well as the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

Fig. 1 is a sectional view of a conventional door damper;

Fig. 2 is a sectional view of a door damper according to a preferred embodiment of the present invention;

Fig. 3 is a sectional view of a door damper operated to a door closed position according to a preferred embodiment of the present invention;

Fig. 4 is a sectional view illustrating a housing main body and a piston rod of a door damper according to a preferred embodiment of the present invention;

Fig. 5 is a sectional view illustrating a bumper, a bumper fixing cap and a space guide bushing of a door damper according to a preferred embodiment of the present invention;

Fig. 6 is a sectional view illustrating an oil seal ring, an oil seal, a tube guide bushing, a tube-shaped contracting member and a seating ring of a door damper

according to a preferred embodiment of the present invention;

Fig. 7 is a sectional view illustrating a cylinder guide of a door damper according to a preferred embodiment of the present invention;

5 Fig. 8 is sectional, plane, and perspective views illustrating a second check valve of a door damper according to a preferred embodiment of the present invention; and

Fig. 8 is bottom, sectional, and plane views illustrating a first check valve of a door damper according
10 to a preferred embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are
15 illustrated in the accompanying drawings.

Figs. 2 to 9 show a door damper according to a preferred embodiment of the present invention.

Referring first to Figs. 2 to 4, the inventive door damper comprises a housing main body 100, one end 150 of
20 which is opened. The housing main body 100 has a relatively large inner diameter wall proximal to the opened end and a relatively small inner diameter wall. Referring to Fig. 4, the relatively large and small diameter walls are divided by a step 141. The relatively large inner diameter wall is
25 provided with an inclined step 140. A spring seating projection 120 is formed on an inner wall of a closed end of the housing main body 100. Between the inclined step 140 and the step 141, an oil seal 70, a tube guide bushing 60, a tube-shaped contracting member 65, and a seating ring 68 are
30 closely abutted to each other in this order and fixed by an

oil seal ring 75. The housing main body 100 is provided with an oil chamber 110 defined between the closed end and the seating ring 68 and fully filled with oil.

Disposed on a central axis of the housing main body 100 is a piston rod 40, around a proximal end of which a cylinder guide 220 having a diameter slightly less than that of the small inner diameter wall of the housing main body 100 is fitted. Fitted around a proximal end of a guide shaft 221 of the cylinder guide 220 is a first check valve 210 provided with a spring seating groove 211 in which one end of a spring 130 is seated. A second check valve 200 is fitted in the guide shaft portion 221 such that it is movable by the first check valve 210 within a limited range. In addition, the other end of the spring 130 is fixedly mounted on the spring seating projection 120 formed on the inner wall of the closed end of the housing main body 100.

Inserted in the opened end 150 of the housing main body 100 is a space guide bushing 50 provided at its distal end with outer and inner flanges 52 and 53 (see FIG. 5). A proximal portion of the space guide bushing 50 is designed having an outer diameter less than that of the large inner diameter wall of the housing main body 100 so that it can be tightly fitted in the large inner diameter wall. A proximal end of the space guide bushing 50 supportably contacts the oil seal ring 75. Preferably, the space guide bushing 50 is coupled on the housing main body 100 through, for example, a high frequency-bonding process.

A bumper-fixing cap 30 is slidably disposed in an operating space 51 defined by the space guide bushing 50. The bumper-fixing cap 30 is fitted around a distal end

portion of the piston rod 40 and provided at its proximal end with an outer flange 31. The flange 31 can be abutted to the inner flange 53 of the space guide bushing 50 when the piston rod 40 is biased by the spring 130, thereby stopping the bumper fixing cap 30. In addition, the bumper-fixing cap 30 is provided at its distal end with a itm811 in which the bumper 10 can be seated with a predetermined gap. The bumper 10 is formed of rubber or foam resin to absorb impact.

Therefore, when a door is rapidly closed, the impact is firstly absorbed by elastic property of the bumper 100, and then secondly absorbed by air formed in the predetermined gap between the bumper and the bumper fixing cap 30, thereby preventing the bounce of the door against the bumper and subsequently eliminating noise.

The oil seal 70 is also formed of rubber or foam resin to prevent the leakage of the oil. A circumferential projection 72 is formed on a central hole, through which the piston rod 40 penetrates, of the oil seal 70, removing the oil from the piston rod 40 when the piston 40 moves in and out of the oil chamber 110 (see Fig. 6).

The oil seal 70 is fixed by the oil seal ring 75. The oil seal ring 75 is provided at its proximal end with a projection 76 being tightly depressed into an outer flange 71 of the oil seal 70, thereby blocking a minute gap that may be formed between the oil seal 70 and the inner wall of the housing main body 100 when the housing main body 100 is deformed by excessive oil pressure. The excessive oil pressure may be created by piston rod 40 receiving the pressure from the bumper 100 when the door is quickly closed. That is, since the oil seal formed of elastic material is

increased in its volume by the volume of the projection, the oil leakage can be prevented. It has been noted through a series of tests that, when pressure applied to the bumper 10 is 45 Kgf, a 0.03 mm gap is created.

5 Referring to Fig. 9, the first check valve 210 is fitted around the proximal end of the guide shaft 221 of the cylinder guide 220. The first check valve 210 is provided at its outer circumference with a step, on which the spring seating groove 211 is formed, and a four-way oil groove 212
10 defining an oil passage.

Referring to Fig. 8, the second check valve 200 is fitted around the guide shaft 221 of the cylinder guide 220 and is capable of moving within a limited range by the first check valve 210. Four radial projections 201 are formed on
15 an inner circumferential wall of the second check valve 200.

A portion of the second check valve 200 is cut to define a variable gap 202. The variable gap 202 is closed during the normal operation. However, when the door is suddenly closed, oil pressure directed into the second check
20 valve 200 is increased to apply force in a direction where a diameter of the second check valve 200 is enlarged, thereby widening the variable gap 202. As the diameter of the second check valve 200 is enlarged, the oil passage defined between the outer circumference of the second check valve 200 and the
25 cylinder main body 100 is blocked, whereby the oil flows only through the widened gap 202. This increases the oil flow speed to reduce the pressure caused by impact.

Meanwhile, the cylinder guide 220 and the first check valve 210 are provided with central hollow holes. Therefore,
30 when the oil is filled in the oil chamber before the piston

rod 40 is inserted in the course of manufacturing the door damper, the oil can be slowly filled along the central hollow holes, thereby preventing air bubbles that may cause the noise from being mixed with the oil.

5 The operation of the above described inventive door damper when the door is opened and closed, particularly when closed, will be described more in detail hereinafter.

When the door is in a closed state, as shown in Fig. 3, the bumper 10 and the bumper fixing cap 30 are inserted into
10 the operating space 51, pushing the piston rod 40 to compress the spring 130. At this point, when the door is opened, the spring 130 is returned to push the piston rod 40, thereby pushing the bumper 10 and the bumper-fixing cap 30 out of the operating space 51 as shown in Fig. 2.

15 When the door is slowly closed, the bumper 10 firstly absorbs impact and then pushes the bumper-fixing cap 30 into the operating space 51. At this point, the bumper fixing cap 30 pushes the piston rod 40 into the oil chamber 110 such that the oil in the oil chamber flows out through a space
20 defined between the oil passage grooves 212 of the first and second check valves 210 and 200 and the inner wall of the housing main body 100. Then, the oil flows into a space defined by the tube guide bushing 60 while contracting the tube-shaped contracting member 65.

25 When the door is rapidly/suddenly closed, the bumper 10 firstly absorbs impact. The impact is secondly absorbed as air is exhausted out of the space 11 defined between the bumper 10 and the bumper-fixing cap 30, pushing the piston rod 40 into the oil chamber 110. At this point, the impact
30 is further attenuated as the oil quickly flows out through

the space defined between the oil passage grooves 212 of the first and second check valves 210 and 200 and the inner wall of the housing main body 100. Furthermore, when the oil quickly flows into the second check valve 200, pressure is applied to the inner wall of the check valve 200, resulting in widening the variable gap 202 while blocking other fluid passages. Therefore, the oil flows out only through the widened gap 202 to remarkably attenuate the impact. The increase of pressure within the oil chamber 110 may cause the housing main body 100 to be bent in a radial direction. However, as described above, since the oil seal ring 75 is depressed into the oil seal 70, the leakage of the oil can be prevented.

15 INDUSTRIAL APPLICABILITY

As described above, the inventive door damper has advantages of avoiding the bounce of the door from the bumper and thereby preventing the noise, while realizing the quick impact absorption using the variable gap of the second check valve. In addition, even when impact is greatly increased, the leakage of the oil can be prevented to improve the reliability. Furthermore, in the course of manufacturing the door damper, since air can be completely removed from the oil chamber, the noise caused by the air bubble can be prevented.

While the present invention has been described and illustrated herein with reference to the preferred embodiments thereof, it will be apparent to those skilled in the art that various modifications and variations can be made therein without departing from the spirit and scope of the invention. Thus, it is intended that the present invention

covers the modifications and variations of this invention that come within the scope of the appended claims and their equivalents.

CLAIMS

1. A door damper comprising:

- 5 the housing main body having proximal and distal ends,
the distal end being opened and the proximal end being closed,
the housing main body having a relatively large inner
diameter wall and a relatively small diameter wall and being
provided at the inner diameter walls with first and second
steps, a spring seating projection being formed on an inner
10 wall of the proximal end;
a piston rod disposed in the housing main body;
an oil seal ring mounted on the first step;
a tube guide bushing closely abutted to the oil seal
ring;
15 a seating ring contacting the tube guide bushing and
fixed by the second step;
a tube-shaped contracting member disposed in the tube
guide bushing;
a cylinder guide connected to the piston rod to be
20 slidable along the small inner diameter wall of the housing
main body;
a first check valve fixed on a proximal end of the
cylinder guide;
a second check valve slidably disposed between the
25 cylinder guide and the first check valve;
a spring mounted between the spring seating projection
and the first check valve;
a space guide bushing movably fitted on the distal end
of the housing main body, the space guide bushing being

provided with a flange;

a bumper fixing cap mounted on a distal end of the piston rod; and

a bumper disposed in a space defined on the bumper-
5 fixing cap.

2. The door damper of claim 1, wherein the cylinder guide is provided with a central hollow hole.

10 3. The door damper of claim 1 wherein the first check valve comprises a 4-way oil passage groove, a spring seating groove, and a central hollow hole.

4. The door damper of claim 1, wherein the second check
15 valve comprises four radial projections formed on an inner wall of the second check valve;

a portion of the second check valve is cut to define a variable gap.

20 5. The door damper of claim 1 further comprising an oil seal having a flange abutted on the oil seal ring, wherein the oil seal ring is provided with a circular projection that is depressed into the flange of the oil seal.

25 6. The door damper of claim 1 wherein the bumper is spaced away from the bumper fixing cap at a predetermined distance.

30

Fig. 1

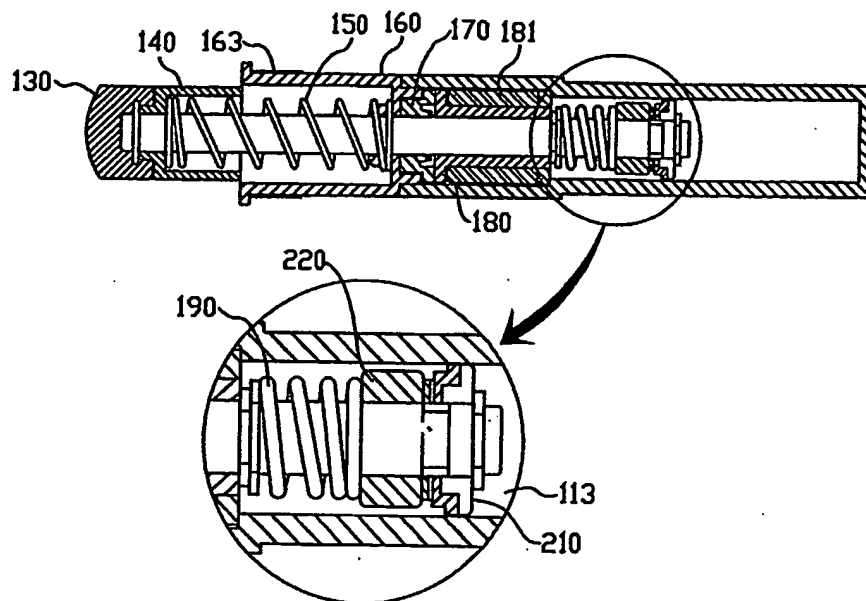


Fig. 2

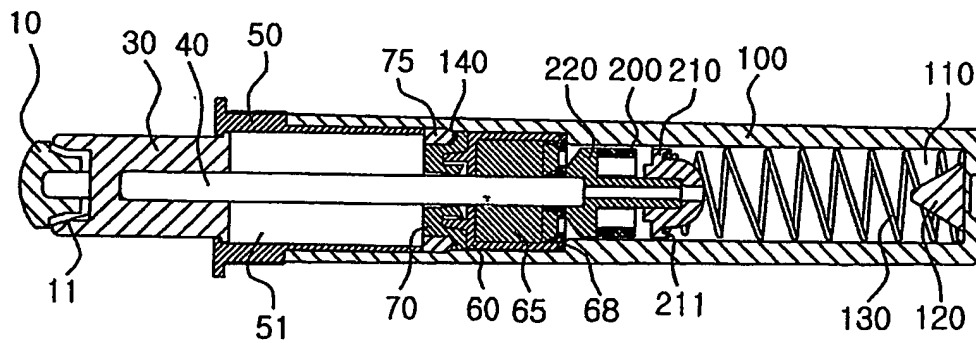


Fig. 3

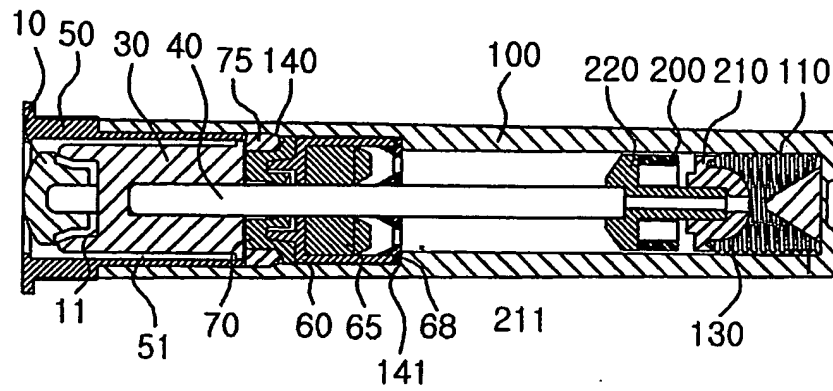


Fig. 4

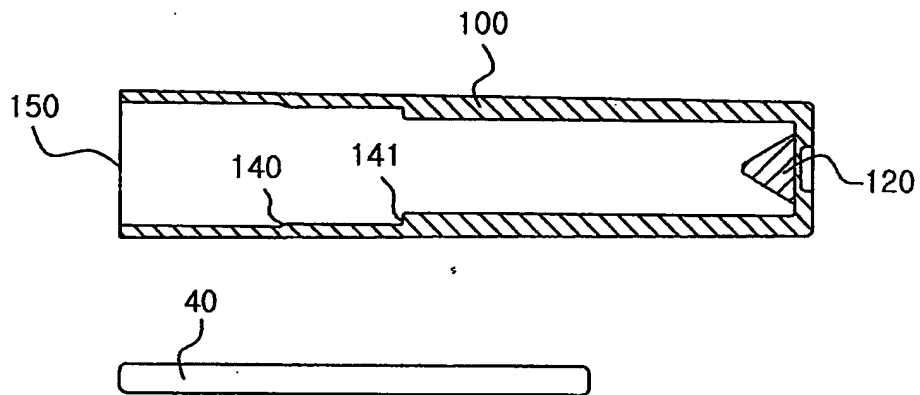


Fig. 5

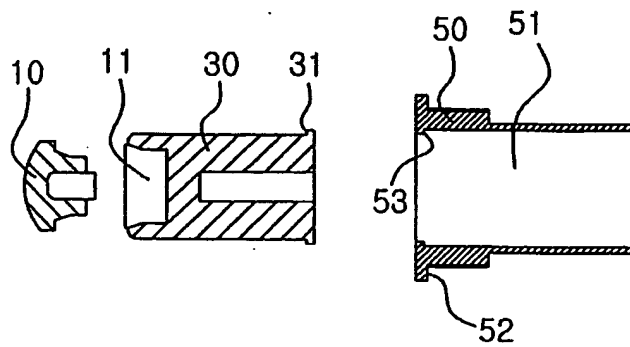


Fig. 6

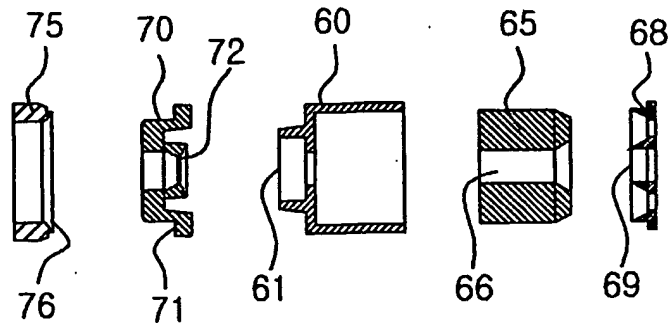


Fig. 7

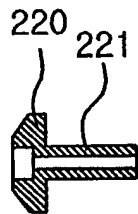


Fig. 8

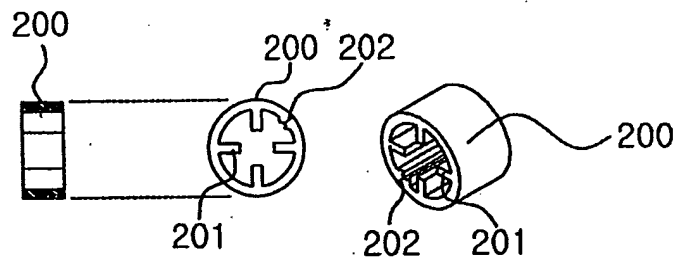
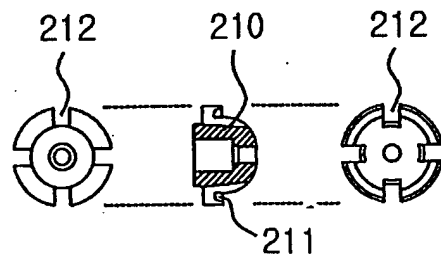


Fig. 9



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2003/001114

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 A47B 96/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 A47B 96/00, E05F 3/04, F16F 9/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korea patents and applications for inventions since 1975

Korea Utility models applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 01-112500 A (Arturo Salice S.p.A) 20 December 2001 see the whole documents	1 - 6
A	KR 20-282449 Y (Moonju Hardware Co., Ltd) 19 July 2002 claims, Fig. 2	1
A	KR 20-166578 Y (Hanil luvetec Co., Ltd) 27 October 1999 see the whole documents	1

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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